analyzed by applying the algorithm to either the standard-form image or the physical image of the mammogram.

Fig. 6 is a flowchart depicting this embodiment of the invention. At step 610, a group of mammograms that have been converted to standard form images by the method of Fig. 4 or by the method of Fig. 5 are used to train a computer aided detection or diagnosis (CAD) algorithm. Advantageously, this group of mammograms is relatively large and is derived from a multiplicity of different mammography systems. For example, the group may include 100 mammograms made on each of four different systems. However, because the differences in the mammograms arising from differences in the different mammography systems have been removed as a result of the methods of Fig. 4 or Fig. 5, the group of mammograms appears to the training algorithm as one large set of mammograms from the same system. At step 620, the CAD algorithm is stored.

At step 630 the CAD algorithm is used to analyze a mammogram that has been made on any mammogram system and then converted to a standard form mammogram.

Alternatively, the training of the CAD algorithm could be performed on the physical images of the group of mammograms formed at step 420 or step 520 in which case the analysis of the mammogram would be performed on its physical image.

By using either standard form mammograms or physical images to train the CAD algorithm and then analyzing the standard form mammogram or physical image, only one CAD algorithm is needed. Moreover, a much larger number of mammograms are available to train the CAD algorithms.

Fig. 7A is a reproduction of a mammogram formed by a conventional mammography system. Fig. 7B is a reproduction of a mammogram formed by the method of Fig. 5 and converted to a standard form. The image of Fig. 7B has been processed to minimize the effect of any fat content in the breast image. A comparison of regions 710A and 720A in Fig. 7A with regions 710B and 720B in Fig. 7B reveals that features that are essentially indistinguishable in regions 710A and 710B are readily revealed in regions 720A and 720B.

What is Claimed:

1. A method for computer aided detection of medical abnormalities in x-ray medical images comprising the steps of:

processing a digital or digitized x-ray medical image to remove distinguishing effects of at least one operating parameter or physical characteristic of an x-ray device used to form said x-ray medical image, thereby forming a processed x-ray medical image; and

processing said processed x-ray medical image with a computer aided detection algorithm that has been optimized with a plurality of x-ray medical images that have been similarly processed with respect to the same operating parameter(s) or physical characteristic(s).

2. The method of claim 1 wherein the x-ray medical image is a mammogram.

3. The method of claim 1 wherein the processing removes distinguishing effects of at least one of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged.

4. The method of claim 1 wherein the processing removes distinguishing effects of all of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged.

5. The method of claim 1 wherein the processing removes distinguishing effects of at least one of the following physical characteristics:

anode material;

source to image distance,

anti-scatter grid geometry;

film characteristics; and

screen-film system.

6. The method of claim 1 wherein the medical image is a mammogram further comprising the step of processing the mammogram to form a physical image representative of glandular tissue in a breast.

7. The method of claim 6 wherein an x-ray image of a reference material is formed at the same time as the mammogram and under substantially the same conditions, said reference material having known x-ray attenuation characteristics representative of different percentages of fat content in the breast, said method further comprising the step of identifying fat content in the mammogram by comparing exposure values in the mammogram with exposure values on the x-ray image of the reference material.

8. The method of claim 1 further comprising the step of further processing the processed image to form a standard form image representative of an image that would be formed at a standard x-ray energy and exposure.

9. The method of claim 8 wherein the standard x-ray energy is in the range 25-28 kVp.

10. The method of claim 8 wherein the standard exposure is in the range 20-200 milli-Ampere-seconds.

11. A method for processing x-ray medical images comprising the steps of:

processing a digital or digitized x-ray medical image to remove distinguishing effects of at least one operating parameter or physical characteristic of an x-ray device used to form said x-ray medical image, thereby forming a processed x-ray medical image; and

further processing the processed image to form a standard form image representative of an image that would be formed at a standard x-ray energy and exposure.

12. The method of claim 11 wherein the x-ray medical image is a mammogram.

13. The method of claim 11 wherein the processing removes distinguishing effects of at least one of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged.

14. The method of claim 11 wherein the processing removes distinguishing effects of all of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged.

15. The method of claim 11 wherein the processing removes distinguishing effects of at least one of the following physical characteristics:

anode material;

source to image distance,

anti-scatter grid geometry;

film characteristics; and

screen-film system.

16. The method of claim 11 wherein the medical image is a mammogram further comprising the step of processing the mammogram to form a physical image representative of glandular tissue in a breast.

17. The method of claim 16 wherein an x-ray image of a reference material is formed at the same time as the mammogram and under substantially the same conditions, said reference material having known x-ray attenuation characteristics representative of different percentages of fat content in the breast, said method further comprising the step of identifying fat content in the mammogram by comparing exposure values in the mammogram with exposure values on the x-ray image of the reference material.

18. The method of claim 11 wherein the standard x-ray energy is in the range 25-28 kVp.

19. The method of claim 11 wherein the standard exposure is in the range 20-200 milli-Ampere-seconds.

20. The method of claim 11 further comprising the step of:

processing the standard form image with a computer aided detection algorithm that has been optimized with a plurality of x-ray medical images that have been similarly processed with respect to the same operating parameter(s) or physical characteristic(s).

21. The method of claim 11 further comprising the step of:

processing the processed image with a computer aided detection algorithm that has been optimized with a plurality of x-ray medical images that have been similarly processed with respect to the same operating parameter (s) or physical characteristic (s).

22. A method for processing mammographic images comprising the steps of:

processing a digital or digitized mammogram formed by a first mammography system to remove effects of at least one of the physical characteristics of the first mammography system and its operating parameters, thereby forming a first processed image;

converting the first processed image into a standard-form mammogram having pixel values that would have been obtained by a standard-form mammography system having a first standard x-ray voltage parameter and a first standard exposure parameter; and

storing said standard-form mammogram

whereby visual comparison of mammograms taken by different mammography systems is facilitated by comparing standard-form mammograms derived from mammograms taken by the different mammography systems.

23. The method of claim 22 wherein the processing removes distinguishing effects of all of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged..

24. The method of claim 22 wherein the medical image is a mammogram further comprising the step of processing the mammogram to form a physical image representative of glandular tissue in a breast.

25. The method of claim 24 wherein an x-ray image of a reference material is formed at the same time as the mammogram and under substantially the same conditions, said reference material having known x-ray attenuation characteristics representative of different percentages of fat content in the breast, said method further comprising the step of identifying fat content in the mammogram by comparing exposure values in the mammogram with exposure values on the x-ray image of the reference material.

26. The method of claim 8 wherein the standard x-ray voltage parameter is in the range 25-28 kVp.

27. The method of claim 8 wherein the standard exposure is in the range 20-200 milli-Ampere-seconds.

28. A method for processing mammographic images comprising the steps of:

forming in a first mammography system a digital or digitized mammogram of a breast along with images of first and second reference materials having thicknesses that range from 0 to the thickness of the breast, one reference material having an attenuation constant that is approximately the same as that of fat and the other having an attenuation constant that is approximately the same as that of glandular tissue;

using exposure information in the images of the first and second reference materials to process the digital or digitized mammogram system to remove substantially all effects related to the physical characteristics of the first mammography system and its operating parameters, thereby forming a first processed image;

converting the first processed image into a standard-form mammogram having pixel values that would have been obtained by a standard-form mammography system

having a first standard x-ray voltage parameter and a first standard exposure parameter; and

storing said standard-form mammogram

whereby visual comparison of mammograms taken by different mammography systems is facilitated by comparing standard-form mammograms derived from mammograms taken by the different mammography systems.

29. The method of claim 28 wherein the processing removes distinguishing effects of all of the following operating parameters:

x-ray energy;

exposure;

thickness of an object being imaged; and

non-interesting tissue in the object being imaged.

30. The method of claim 28 further comprising the step of processing the mammogram to form a physical image representative of glandular tissue in a breast.

31. The method of claim 28 wherein the standard x-ray voltage parameter is in the range 25-28 kVp.

32. The method of claim 28 wherein the standard exposure is in the range 20-200 milli-Ampere-seconds.